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AN EXPERIMENT IN LIBRARY APPLICATION OF XEROX LDX FACSIMILE TRANSMISSION EQUIPMENT. PHASE I: PLANNING AND ANALYSIS.

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Phase I of the experiment described had a twofold purpose: (1) to determine costs and work out arrangements for a one-month test of the Long Distance Xerography (LDX) telefacsimile system for interlibrary transmission of printed pages between the Berkeley and Davis campuses of the University of California, and (2) to analyze the LDX system in terms of its potential for making possible increased sharing of library resources by regional or intercampus networks of cooperating libraries. A cost analysis was made for several different degrees of usage of the equipment, taking into account staff time, equipment costs and supplies, and the general set of conditions which must exist before the LDX system is used to advantage was found. From the preliminary analysis the following conclusions were reached: (1) the LDX system appears to be capable of providing rapid, high-quality transmission of printed pages rom one library to another, with elapsed time for each transaction averaging 2.5 hours instead of the week or more typically required. (2) the cost of an LDX system precludes its use in libraries at current interlibrary photoduplication service levels; and (3) there is great potential of expanding access to existing large serials collections by establishing an LDX network serving several libraries, each with smaller collections of the more frequently used titles. (CM)

AN EXPERIMENT IN LIBRARY APPLICATION OF XEROX LDX FACSIMILE TRANSMISSION EQUIPMENT

PHASE I: PLANNING AND ANALYSIS

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A Study Prepared for
Council on Library Resources, Inc.
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June 13, 1966

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INTRODUCTION

Phase 1 of the experiment has had a twofold purpose:

1) To determine costs and work out all arrangements for equipment installation, transmission links, building space, staffing, scheduling, and experimental design for a one-month test (Phase 2) of the LDX telefacsimile system for interlibrary transmission of printed pages between the Berkeley and Davis campuses of the University of California.

2) To analyze the LDX system in terms of its potential for making possible increased sharing of library resources by regional or intercampus networks of cooperating libraries.

Objective #1 has been accomplished, and the plans for the LDX test are summarized in the proposal for Phase 2. Objective #2 is represented by the main body of this report. The analysis is presented only in such depth as seems appropriate before a working test of the equipment is performed, and is intended to serve as an aid toward assessing the value of such a test. The cost and performance data show the general set of conditions which must exist before the LDX system may be used to advantage.

SECTION I - BACKGROUND

The concept of telefacsimile systems as a means of rapid transfer of information between libraries has great appeal, bringing to mind attractive possibilities such as great reductions in duplication of library resources, or widespread quick access to vast central stores of information. Although these ideas will undoubtedly become realities at some future time, there has been no demonstration that any telefacsimile system is economically feasible for present interlibrary use. Realistic information as to cost and utility for libraries must be obtained by using the equipment in a library working situation and by analyzing the adaptation of the library to its use.

This interim report is an effort to describe in rather broad terms the framework and scale of library operations appropriate to the LDX system.

SECTION II - GENERAL DESCRIPTION OF LDX SYSTEM

A. Physical Description.

In terms of typical library equipment, the LDX (Long-Distance Xerox) is a relatively sophisticated, costly system. It is comprised of three basic elements, the Scanner (transmitter), the Transmission Link, and the Printer (receiver). In size, the Scanner and Printer are roughly comparable to the Xerox 914 (See Appendix 1 - LDX Specifications for a detailed description).

B. Working Principle.

The Scanner operates by sweeping a narrow light beam back and forth across the page to be copied. The reflection of this beam is focused into an electronic system where the variations in light reflected by the image on the page are converted into electrical impulses. These impulses are transmitted via either cable or microwave signals to the Printer, where they are converted back into light by a cathode ray tube. This tube projects the light impulses onto a drum, from which a finished copy is produced by the conventional Xerox process.

C. Transmission Link.

The LDX requires a transmission link with a frequency band-width of at least 48 kc (kilocycles), which is equivalent to twelve ordinary telephone lines. If faster performace is desired, a 240 kc band-width channel may be used, approximately doubling transmission link costs but increasing output speed by a factor of 5 at the same time. The 48 kc and the 240 kc telephone company channels are commonly referred to as a TELPAK "A" and a TELPAK "C", respectively.

Channels of this capacity may be leased from a common carrier, such as Bell Telephone Co., or may be set up as privately owned microwave or co-axial cable systems.

D. Resolution.

The resolution is normally pre-set at the factory to either 135 or 190 LPI (scanning lines per inch). Sample copies show that 190 LPI is likely to provide adequate resolution for normal library requirements.

E. Speed.

The rate at which pages can be transmitted depends upon the resolution (LPI) and the channel band-width employed, ranging from .88 pages per minute to 8.75 pages per minute, or conversely, from 1.14 minutes per page to 0.114 minutes per page. Table 1 indicates the various resolution/band-width/rate relationships.

F. Materials which can be Transmitted.

The Scanner will accomodate single pages only, and is not capable of copying directly from bound or unbound volumes. Pages may range in size from a minimum of $3\frac{1}{4}$ inches by 5 inches to a maximum of $9\frac{1}{2}$ inches wide by any length. Original copies, Xerox copies or photocopies of printed pages, typescript, manuscript, line drawings, maps, etc. of any color may be transmitted. Copies produced by the Printer are positive (black on white), not effective in reproduction of half-tones, and are comparable in appearance to the copies produced by the Xerox 914.

G. Method of Operation.

Single sheets to be transmitted are manually fed into the LDX Scanner's document conveyor one at a time. Copies are produced by the Printer on a continuous strip of paper, which is automatically cut to size. No operator is necessary for the Printer after its initial daily warm-up cycle.

TABLE I

LDX Speed/Lines per Inch

and

Production Capacities

Transmission Channel	LPI	8-1/2 x 11 Pages Per			Seconds per Page	Minutes per 10 pages
		Minute	Hour	8 hr. Day		
48 kc	135	1.75	105	840	34.3	5.71
	190	.88	52	416	68.2	11.36
240 kc	135	8.75	525	4200	6.86	1.14
	190	4.38	262	2096	13.7	2.28

SECTION III - COST OF THE LDX SYSTEM

A. Equipment and Supplies.

The equipment is marketed on a lease basis by the Xerox Corporation, with a minimum charge of $550 per month for each Scanner and $650 per month for each Printer. This base rental includes a footage allowance of 2500 feet per month (2500 copies) for each machine (see Table 2). To this minimum charge of $1,200 for a pair of machines must be added the monthly charge for the transmission link, which would be on the order of $700 for a short distance, and about $1,800 for a 500-mile 48 kc link including charges for connecting terminals. The costs computed in this report are based on Pacific Telephone Company monthly charges for connecting equipment (A4 Data Terminals) and TELPAK "A" channels, priced as part of the State of California communications system.

Equipment and transmission link costs for a one-way LDX facility between the Berkeley and Davis campuses of the University of California are listed at various volumes of use in Tables 3-6 and are shown graphically in Figure 1. Table 6 represents 9½ hours per day at full capacity and is included only to show how low the cost per copy would be if such heavy use could be attained in a library system.

To the equipment costs described above must be added approximately 1¢ per page for LDX supplies, and an allowance of 5¢ per page for Xerox copies (needed in most cases since the Scanner will accommodate single sheets only).

B. Staff Time.

The Staff time required per LDX transaction would vary considerably

TABLE 2

LDX PRICE SCHEDULE

Monthly Footage	Each Scanner	Each Printer
Base Rental 0-2500 feet	$550 per month	$650 per month
Excess Footage	All Scanners	All Printers
0-10,000	$.020 per ft.	$.030 per ft.
10,000-50,000	.015	.025
50,000-100,000	.010	.020
100,000-175,000	.0075	.0175
175,000-1,000,000	.005	.015
1,000,000-up	.005	.010

Base rental for each unit includes 2500 feet (approximately 2500 pages) per month. After base rental and footage allowance are deducted for each unit, total excess footage for all Scanners and for all Printers in a system is priced as shown above.

TABLE 3

LDX Costs: Berkeley - Davis 48 Kc Link 190 Lines per Inch

Volume of Use: 1,000 Pages per Month

ITEM	Installation Charge	Monthly Charge	Annual Charge	Cost per Page	Cost per 10-Page Transaction
LDX Scanner	$300	$550	$6,600	$0.55	$5.50
LDX Printer	450	650	7,800	.65	6.50
A4 Data Terminals (2 each)	500	680	8,160	.68	6.80
TELPAK "A" (75 miles)	--	657	7,884	.657	6.57
TOTALS	$1,250	$2,537	$30,444	$2.537	$25.37

TABLE 4

LDX Costs: Berkeley - Davis 48 Kc Link 190 Lines per Inch

Volume of Use: 2500 Pages per Month

ITEM	Installation Charge	Monthly Charge	Annual Charge	Cost per Page	Cost per 10-Page Transaction
LDX Scanner	$300	$550	$6,600	$0.22	$2.20
LDX Printer	450	650	7,800	.26	2.60
A4 Data Terminals (2 each)	500	680	8,160	.272	2.72
TELPAK "A" (75 miles)	--	657	7,884	.263	2.63
TOTALS	$1,250	$2,537	$30,444	$1.015	$10.15

TABLE 5

LDX Costs: Berkeley - Davis 48 Kc Link 190 Lines per Inch

Volume of Use: 5,000 Pages per Month

ITEM	Installation Charge	Monthly Charge	Annual Charge	Cost per Page	Cost per 10-Page Transaction
LDX Scanner	$300	$600	$7,200	$0.120	$1.20
LDX Printer	450	725	8,700	.145	1.45
A4 Data Terminals (2 Each)	500	680	8,160	.136	1.36
TELPAK "A"	--	657	7,884	.131	1.31
TOTALS	$1,250	$2,662	$31,944	$0.532	$5.32

TABLE 6

LDX Costs: Berkeley - Davis 48 Kc Link 190 Lines per Inch

Volume of Use: 10,000 Pages per Month

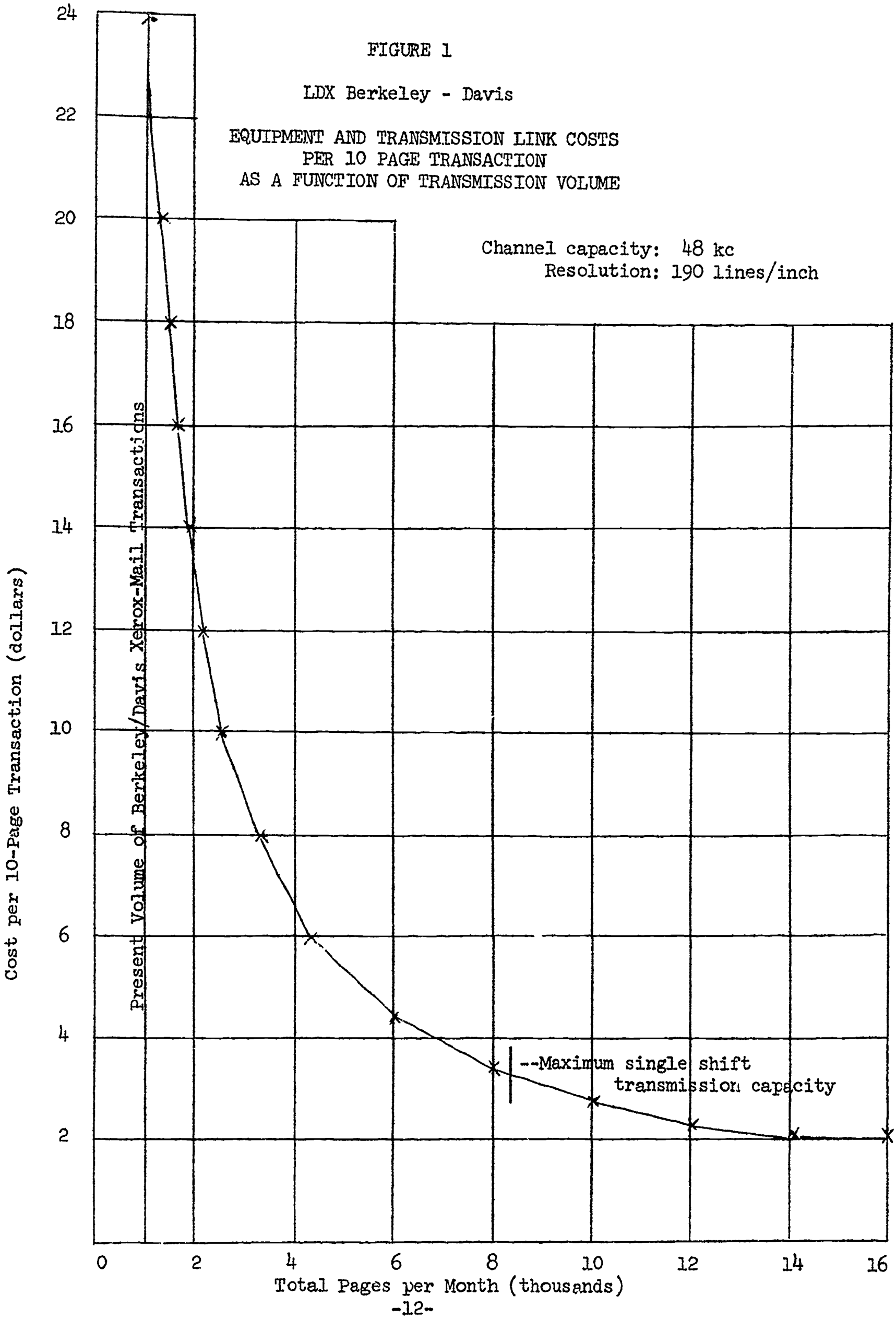
ITEM	Installation Charge	Monthly Charge	Annual Charge	Cost per Page	Cost per 10-Page Transaction
LDX Scanner	$300	$700	$8,400	$0.07	$0.70
LDX Printer	450	875	10,500	.0875	.875
A4 Data Terminals (2 each)	500	680	8,160	.068	.68
TELPAK "A"	--	657	7,884	.0657	.657
TOTALS	$1,250	$2,912	$34,944	$0.2912	$2.91

FIGURE 1

LDX Berkeley - Davis

EQUIPMENT AND TRANSMISSION LINK COSTS
PER 10 PAGE TRANSACTION
AS A FUNCTION OF TRANSMISSION VOLUME

Channel capacity: 48 kc
Resolution: 190 lines/inch



depending on the method used in providing service. If requested items are to be immediately obtained from the shelves (main stack or branch library), Xeroxed, and transmitted promptly, the elapsed time for completion of requests will be minimized, but staffing costs will be greater than with a slower, but more economical method where tasks are back-logged and done in batches. In either case, the actual transmitting time is easily calculated from Table I, and would cost approximately 50¢ for a 10-page transaction if the operator is paid $2.50 per hour. (This is computed at the slowest LDX rate of .88 pages per minute).

Costs for staff time for a 10-page transaction are estimated and listed below, considering only the working time actually required for each step. These costs may be regarded as near minimum, since no account is made of standby time (staff kept available for prompt response to requests) or of time spent on requests which cannot be filled due to incomplete or incorrect citation or to unavailability of the desired material.

TRANSMITTING FUNCTIONS:	Estimated average no. of Minutes
1. Receive request via telephone, record information on work-sheet	4
2. Check for call no. and location	5
3. Retrieve item from shelves (5-45 minutes depending on location)	15
4. Make Xerox Copy, add requester's name, campus address & telephone number	15
5. Return item for reshelving	5
6. Reshelve item	2
7. Transmit	12
8. File record of transaction	5
Subtotal	63 Minutes

RECEIVING FUNCTIONS:

9.	Receive item from Printer, prepare for delivery	3
10.	Deliver item to requester	20
11.	Make and file record of transaction	3
	Subtotal	26 Minutes
	TOTAL	89 Minutes

Total staff time would thus average about 1½ hours per 10-page transaction, costing, at $2.50 per hour, $3.75 per transaction. These time estimates are necessarily arbitrary, pending actual experience with the system, but are considered to be reasonable approximations. Actual staff costs per transaction would obviously vary with the volume of work, since for any staffing arrangement there is a certain level of workload resulting in optimum use of staff time. On days when volume of work is lower than optimum, labor cost per transaction is higher; on days when volume of work is higher than optimum, costs per transaction will be reduced, but elapsed time per transaction will somewhat be greater due to delays or necessary batching of some processes.

C. Cost Summary.

For a 10-page transaction over a distance of 75 miles where volume of use averages 10,000 pages per month, the cost pro-rated for each component may be summarized as follows:

LDX Scanner	$0.70
LDX Printer	.875
Terminals	.68
TELPAK "A"	.657
Supplies	.10
Xerox Copies	.50
Total Equipment	$3.51
Staff Time	3.75
Total cost for 10-page transaction.	$7.26

This cost can be considered minimum since it represents slightly more than single shift capacity of the equipment. It should be noted again then that this cost would vary greatly from one situation to another, depending not only on volume of use, but also on cost of the transmission link, and whether or not the full cost of the transmission link must be borne by the LDX service.

SECTION IV - SERVICE-TIME CAPABILITIES OF THE LDX SYSTEM

Speed is the essential capability which makes this equipment potentially valuable for library use, in spite of its apparent costliness. The volume of traffic in interlibrary transfer of information is constantly increasing, and procedures now in general use tend to be slow and cumbersome. The average elapsed time for an interlibrary loan transaction between University of California campuses is now 6-7 working days. This time could be reduced to less than 3 hours for most periodical articles, technical reports, and government publications (the types of material which are now usually copied by Xerox and mailed). Such rapid interlibrary service is unprecedented, and would make possible entirely new concepts of cooperative sharing and distribution of library resources.

As indicated in Section III, elapsed time for filling a request via LDX would vary according to the procedures and staffing arrangements provided. However, using the working time estimates outlined, and allowing for an average 10-minute delay time for each step in the procedure affecting elapsed time, the average elapsed time for a 10-page transaction would be 157 minutes, or slightly over 2½ hours.

It will be noted that implicit in the procedures outlined, some major deviations from present interlibrary loan practice are introduced in order to gain maximum benefit from the rapid transmission capability of the LDX system:

1. The requester is not required to submit his request to his campus interlibrary loan office where time-consuming procedures are normally required, such as formal verification or citation of reference source,

but may telephone his request directly to the LDX office at the source library. If the information he supplies is not sufficiently complete or accurate to enable the source library to identify the item desired, or if the item is not available, the requester would be notified directly by telephone.

2. After the transmission is completed, the material will be delivered to the requester, thereby eliminating delay time caused where material is held for pick-up by requester and substituting messenger's time for requester's time.

3. The A.L.A. forms for interlibrary loans and requests for photocopy would not be used. The code they represent places time-consuming burdens on the borrowing library, the philosophy being that the lending library is performing a service for someone outside its normal clientele, and that it should be burdened with as little work as possible, and thus, requests should be carefully verified before submission. With an LDX service, with its obvious prerequisite of closely cooperating libraries, a simple work-sheet should be sufficient as an instruction for and a record of each transaction, most of the work being performed by the source library. Work measurement studies could then provide the basis for budgetary transfers to cover the work of the source library.

SECTION V - LIBRARY SYSTEMS ORGANIZED FOR LDX SERVICE

A. Time and Cost Relations.

The LDX system may be effectively utilized to reduce the delay time encountered by library patrons in gaining access to any of the world's literature. In order to provide a context for a hypothetical LDX library network, to provide such service, first consider the normal relations that exist between service time, distance from patron to library and access cost.

To provide access to material, either the patron must go to the library or the material (or a copy) must be delivered to him. The patron may walk, drive or fly to the library, depending upon his distance from it; the material may be delivered by messenger, express or mail. Each of these methods has a different relationship of service time to cost.

For example, in transporting the patron by auto to the library the time required is essentially a linear function of the distance traveled:

$$T = F + aD$$

where, F represents the fixed service time in the library and the fixed time in getting to the library, e.g., parking his auto. D represents the one-way distance traveled and a, the time required for each unit of distance (remembering that a round trip is required).

Cost may be similarly represented:

$$C = vD + mT$$

where v is the transport cost per unit of distance and m is the man cost per unit of time. As was just shown, time is also a function of distance and therefore, this may be rewritten:

$$C = mF + maD + vD.$$

To obtain time and cost as a function of distance for a "normal" situation, substitute the following:

$a = 0.04$ hours per mile

$m = 2.5$ dollars per mile

$v = 0.10$ dollars per mile

$F = 1.0$ hours

giving,

$$T = 1.0 + 0.04D$$

$$C = 2.5 + 0.20D$$

Since LDX transmission is electronic, service time is independent of distance. A prime component of service cost is the fixed investment required in providing the transmission capability--the LDX equipment, interface equipment, and the communication line or microwave link. The communication line cost is dependent both upon distance and terrain. However, for simplicity, only distance is here considered. As an order of magnitude estimate, ten dollars per mile per month will be used with the warning that some applications may cost twice as much. This gives the following relation:

$$C_{LDX} = F_{LDX} + v_{LDX}D$$

where F_{LDX} represents the fixed staff and equipment costs pre-rated to the transaction, and v_{LDX} is the line charge per unit distance.

As indicated earlier, the cost of an individual transaction is dependent upon the total volume of use. For present purposes, assume that 5,000 pages per month (60% of single shift capacity) will be sent. This gives the following:

$$F_{LDX} = 8 \text{ dollars}$$

$$v_{LDX} = 0.02 \text{ dollars per mile}$$

$$C_{LDX} = 8 + 0.02\ D$$

Similar functions can be developed for the other access methods. Figure 2 depicts the relation of service time, distance, and cost for a 10-page item for each method. This figure shows that the LDX system may reasonably be considered to provide rapid access to present library resources as demands for library services increase over large geographical areas.

B. Library Networks.

Consider a central library organized to provide material to cooperating libraries through an LDX network. The objective of such a network is to eliminate the need to duplicate the collection and yet provide rapid access. The required cost of the LDX system is dependent upon the expected use of the collection. The general expression for the network cost is the following:

$$T_{LDX} = (p/k + s + eC_{LDX})\ V$$

where the parameters are:

p = the initial purchase and processing cost per item

k = the amortization period for the initial costs

s = the storage cost per item per unit time

e = the expected use per item per unit time

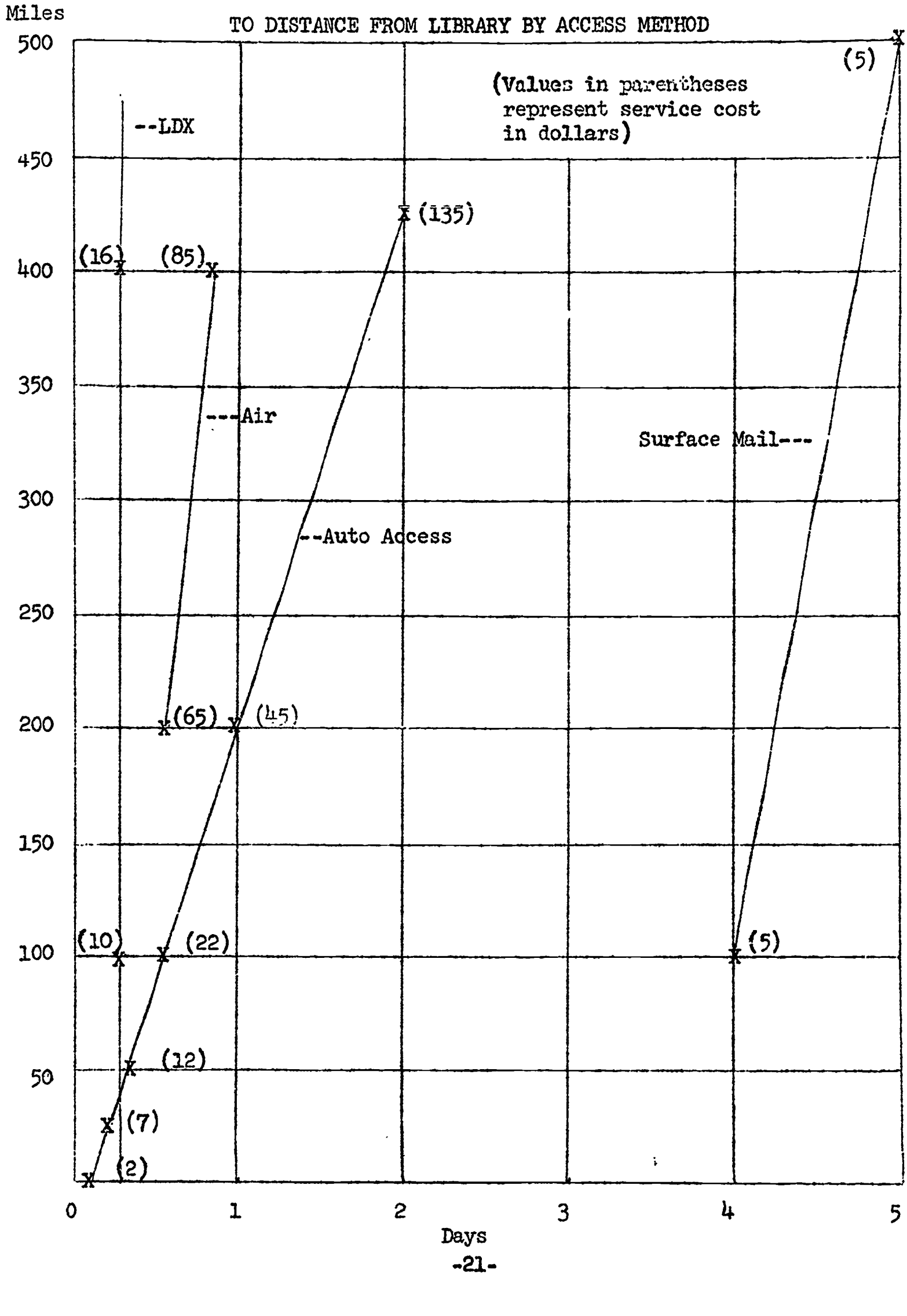
v = the number of items in the collection

C_{LDX} = the LDX service cost per item used, as previously defined

The comparable expression for the cost of the libraries with duplicated collections instead of the LDX system is:

FIGURE 2

RELATION OF SERVICE TIME
TO DISTANCE FROM LIBRARY BY ACCESS METHOD



$$T_{normal} = (p/k + s)\ VN$$

where N is the total number of libraries in the network.

Finally, the following equation provides the costs of current levels of service where such materials are not duplicated by the libraries, but are supplied through interlibrary loan:

$$T_{ILL} = (p/k + s + eb)\ V$$

where b is the interlibrary loan service cost per item borrowed.

To develop the costs of operating the library system utilizing any of these approaches, the period of useful life of the library materials must be established in order to properly amortize the costs of purchasing and maintaining the collection. A number of library use studies have shown that the major portion of large research library collections have very low expected use, that is, one use in ten or more years. With respect to such materials, amortization over a fifty year-period is reasonable since, with rare exceptions, materials older than this will have usage on the order of once in thirty to fifty years.

In order to make the most of the available LDX capacity, transmission will be restricted to serials articles. For present purposes these will be considered to have an average of ten pages.

For comparison purposes these assumptions lead to the following values:

p = 20 dollars per volume

k = 50 years

s = 0.10 dollars per year

e = 0.10 uses per volume per year

v = 100,000 volumes

C_{LDX} = 12 dollars per use (60% capacity, 200 mile average link distance)

b = 5 dollars per item used

N = 10 libraries

The following then are the annual costs for each of the approaches for each 100,000 volumes so handled:

$$T_{LDX} = (0.40 + 0.10 + 0.10 \times 12)\ 100,000$$
$$= \$180,000$$

$$T_{normal} = (0.40 + 0.10)\ 100,000 \times 10$$
$$= \$500,000$$

$$T_{ILL} = (0.40 + 0.10 + 0.10 \times 5)\ 100,000$$
$$= \$110,000.$$

A major research library serials collection will contain more than 30,000 titles, with a total of at least one-half million volumes. Assuming that 400,000 volumes have the type of use just discussed, the LDX system would provide nearly equivalent service to that of purchasing all of these backfiles at an annual saving of more than one million dollars. At the same time the service would cost almost three hundred thousand dollars a year more than current interlibrary loan services.

There are two major elements of differing quality in the service provided by the three systems. The first, service time, has been the key item of concern in investigating the operation of facsimile transmission. The second is concerned with the ability to browse in the collection. While little objective information is available concerning current browsing habits, there is little question that browsing is facilitated by the availability of a large collection. Whether this enhanced browsing is worth the cost of duplicating the collections can not be answered within the context of the current study.

SECTION VI - CONCLUSIONS

1. The LDX system appears to be capable of providing rapid, high-quality transmission of printed pages from one library to another, with elapsed time for each transaction averaging 2½ hours instead of the week or more now typically required.

2. The cost of an LDX system precludes its use in libraries at current interlibrary photo duplication service levels.

3. There is great potential for expanding access to existing large serials collections by establishing an LDX network serving several libraries, each with smaller collections of the more frequently used titles.

APPENDIX I

LDX EQUIPMENT SPECIFICATIONS

I. Scanner.

A. Input Pages

1. Up to $9\frac{1}{2}$ inches wide by any length.
2. $3\frac{1}{4}$ inches by 5 inches minimum size.
3. Accepts limited variations in image, color, and background.

B. Operator Signals

1. "Ready" light indicates system is ready to transmit; also flashes intermittently during transmission of negative originals.
2. "Standby" light illuminates during warm-up period; to indicate transmission failure; or when printer is not ready to receive.

C. Feed System

Manual conveyor feed. Accepts creased, torn and dog-eared sheets.

D. Scanning

Cathode ray tube line-scan with photomultiplier pickup, $8\frac{1}{4}$ inches wide.

E. Power

115 volts, single phase AC (conventional grounded circuit).

F. Environment

1. Temperature: 50° to 100°F.
2. Relative Humidity: 15% to 85%.
3. Elevation: 0 to 5500 feet above sea level.

G. Size

1. 46 inches high.
2. 24 inches wide.
3. 46 inches deep.
4. Floor Area: 7.6 square feet.
5. Weight: 425 pounds.

II. Printer.

A. Output Pages

1. 8½ inches wide by any length.
2. Prints on ordinary paper from 2,000 feet roll; also can print on paper offset master stock in roll form.
3. Automatic cutter trims documents to length.

B. Operator Signals

1. Reload light indicates low paper supply.
2. "Standby" light indicates warm-up period in progress; also indicates transmission failure.
3. "Ready" light indicates the printer is properly connected to the scanner and is ready to receive and print.

C. Printing

Cathode ray tube, optics, xerographic drum and electronic circuits.

D. Power

115 volts, single phase AC (conventional grounded circuit).

E. Environment

1. Temperature: 60° to 90°F.
2. Relative Humidity: 15% to 85%.
3. Elevation: 0 to 5,500 feet above sea level.

F. Size

1. 58.9 inches high.
2. 25.6 inches wide.
3. 33 inches deep.
4. Floor area: 5.9 square feet.
5. Weight: 650 pounds.

APPENDIX II

EQUIPMENT AND TRANSMISSION LINK COSTS FOR AN LDX NETWORK INTERCONNECTING THE NINE CAMPUSES OF THE UNIVERSITY OF CALIFORNIA

		Installation	Monthly Charge	Monthly Charge x 12 Months
1.	LDX Equipment			
	5 scanners	$1,500	$2,960	$ 35,520
	9 printers	4,050	5,850	70,200
	TOTALS	$5,550	$8,810	$105,720
2.	Connecting Equipment (Bell Tel.)			
	Switching Gear - UCLA 6-way	$ 300	$ 340	$ 4,080
	UCLA 3-way	100	230	2,760
	Berkeley 6-way	300	340	4,080
		$ 700	$ 910	$ 10,920
	A4 Terminals - UCLA - 4 southern campuses (4 ea.)	$ 600	$ 200	$ 2,400
	UCLA - Berkeley	150	280	3,360
	Berkeley - UCLA	150	280	3,360
	Berkeley - Davis, San Francisco, Santa Cruz (3 ea.)	450	600	7,200
	Davis, San Francisco, Santa Cruz, Santa Barbara, San Diego, Irvine, Riverside	1,750	2,380	28,560
	TOTALS	$3,800	$4,650	$ 55,800
3.	TELPAK "A" Mileage (Bell Tel.)			
	Berkeley - San Francisco		$ 41	$ 495
	Berkeley - Santa Cruz		772	15,742
	Berkeley - Davis		657	7,885
	Berkeley - UCLA		1,109	13,310
	UCLA - Irvine		160	1,920
	UCLA - Riverside		323	3,876
	UCLA - San Diego		531	6,378
	UCLA - Santa Barbara		579	6,948
	TOTALS		$4,172	$ 56,554

TOTALS (rounded): INSTALLATION $ 10,000

TOTAL ANNUAL CHARGE $220,000

6/13/66:cw